

Building Better Brains: The Core Story of Early Brain and Child Development (EBCD)

Dr. Amy Shriver, MD

Material developed by the American Academy of Pediatrics

A privilege and responsibility

21st Century Pediatrics



I have no financial disclosures.

Objectives

This talk will help you to:

- Define the critical elements of Early Brain and Child Development (EBCD)
- Describe factors (supportive and detrimental) that shape the developing brain
- Identify specific actions to take to promote EBCD

Our Agenda

*“Virtually every aspect of early human development, from the brain’s evolving circuitry to the child capacity for empathy, is affected by the **environment** and **experiences** that are encountered in a cumulative fashion, beginning in the prenatal period and extending throughout the early childhood years.”*

- *Neurons to Neighborhoods*

National Research Council, Institute of Medicine, Committee on Integrating the Science of Early Childhood Development; Shonkoff JP, Phillips DA, editors. From Neurons to Neighborhoods: The Science of Early Childhood Development. Washington, DC: The National Academies Press; 2000:6

Our Agenda

“It’s all about nurturing relationships. Early relationships build their brains and our future.”

*Andrew Garner, MD, PhD, FAAP
Chair, AAP EBCD Leadership Workgroup (2012-2014)*

Why is ECBD Important?

- The brain is hard wired for social, emotional, intellectual and developmental trajectories by the age of 5
- What happens early affects all aspects of a child's development
- Nurturing relationships in the early years are critical
- First 1,000 days have a profound impact

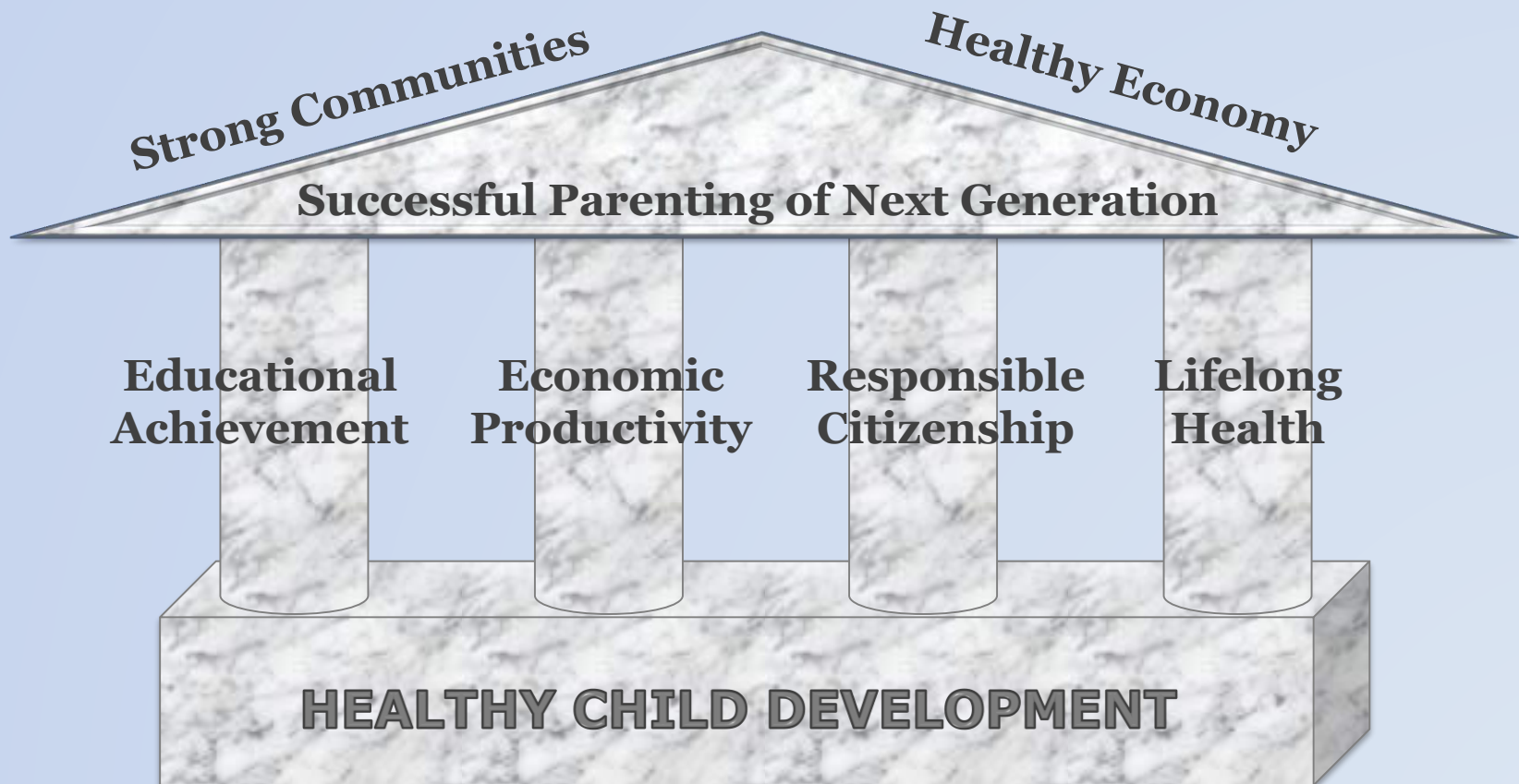
Source: Center on the Developing Child at Harvard University Website.
<https://developingchild.harvard.edu/>. Accessed on July 19, 2018.

Why is ECBD Important?

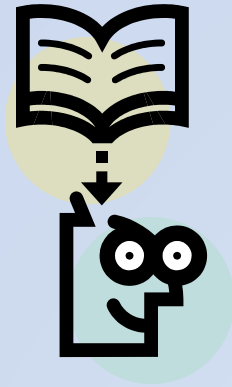
- Executive function supports children's later success
- Toxic stress has a negative impact on a child's development
- Early interventions are critical for optimal life course outcomes

Source: Executive Function & Self-Regulation. Center on the Developing Child at Harvard University Website. <https://developingchild.harvard.edu/science/key-concepts/executive-function/>. Accessed on July 16, 2018.

The Foundation of a Successful Society is Built in Early Childhood



Key Concept 1



**Genes plus experience shape the
developing brain**



4 Tenets of Early Brain and Child Development

1. Brains are built over time, **starting before birth**, and functions are cumulative, integrated, and interdependent
2. **Genes PLUS experience** shape the architecture of the developing brain
3. **Toxic stress** disrupts the developing brain and has negative lifelong effects on learning, behavior, and health
4. Building **resilience** is the key to mitigating toxic stress and promoting lifelong health



Why Early Experiences Matter



Newborn Brain
Average Weight
333 grams



2 Year Old's Brain
Average Weight
999 grams

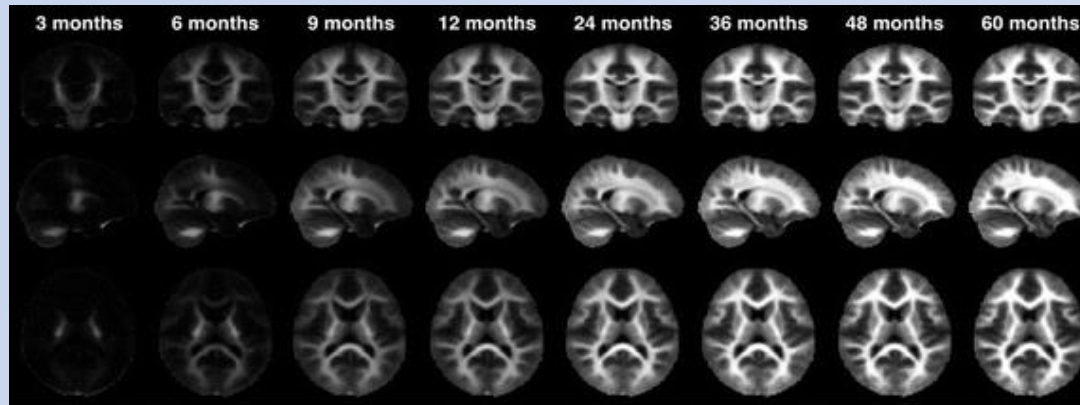
IsaacMao. Brain.2005. <https://www.flickr.com/photos/isaacmao/19245594/in/album-72057594061652307/>. Accessed June 16, 2018.

5 Principles of Brain Development

- Experience dependent
- Cumulative
- Integrated
- Dynamic
- Asynchronous

Garner A, Saul R. *Thinking Developmentally*. Itasca, IL: American Academy of Pediatrics; 2018.

Early Brain Development



Birth

Born with
lifetime supply
of neurons



3 Years

Synapses form
based on early
experiences



15 Years

Mind is fine
tuned to the
world children
inhabit

Brain Image Scan :Dean, D.C., O'Muircheartaigh, J., Dirks, H. et al. Brain Struct Funct (2015) 220: 1921. <https://doi.org/10.1007/s00429-014-0763-3>, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4481335/figure/Fig1/>, Accessed August 28, 2018

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



Plasticity

- Plasticity refers to the brain's unique ability to literally “rewire” itself in response to experience
- Experience influences not only the foundational architecture, but the on-going connectivity and functionality
- Two different types of plasticity...

Garner A, Saul R. *Thinking Developmentally*. Itasca, IL: American Academy of Pediatrics; 2018.

How Early Brains are Built

**Brains are built over time,
from the bottom up.**

Brains have plasticity.

Synaptic:

- Variation in strength of connections
- (A whisper to a shout)
- Lifelong

Cellular:

- Variation in number of connections
- (one voice vs a stadium)
- Declining by age 5



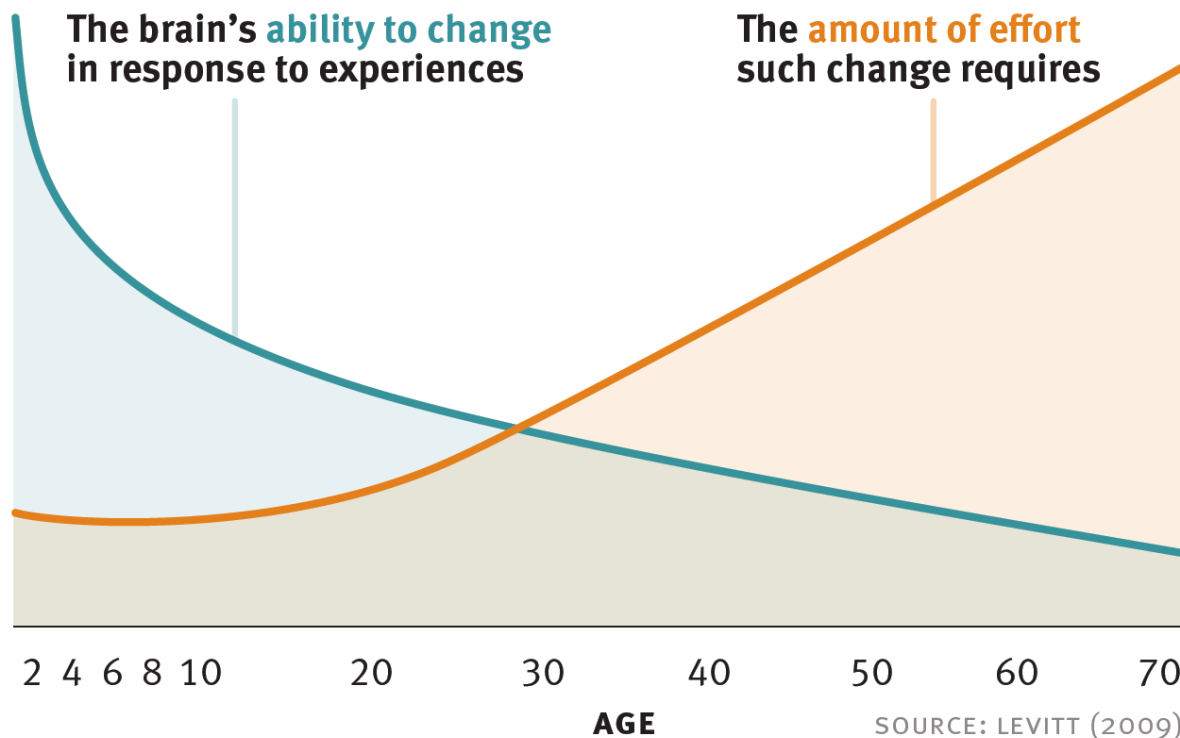
1 million connections per second



Early Brain and Child Development

BUILDING BRAINS, FORGING FUTURES

A Program of the American Academy of Pediatrics



Center on the Developing Child  HARVARD UNIVERSITY

www.developingchild.harvard.edu

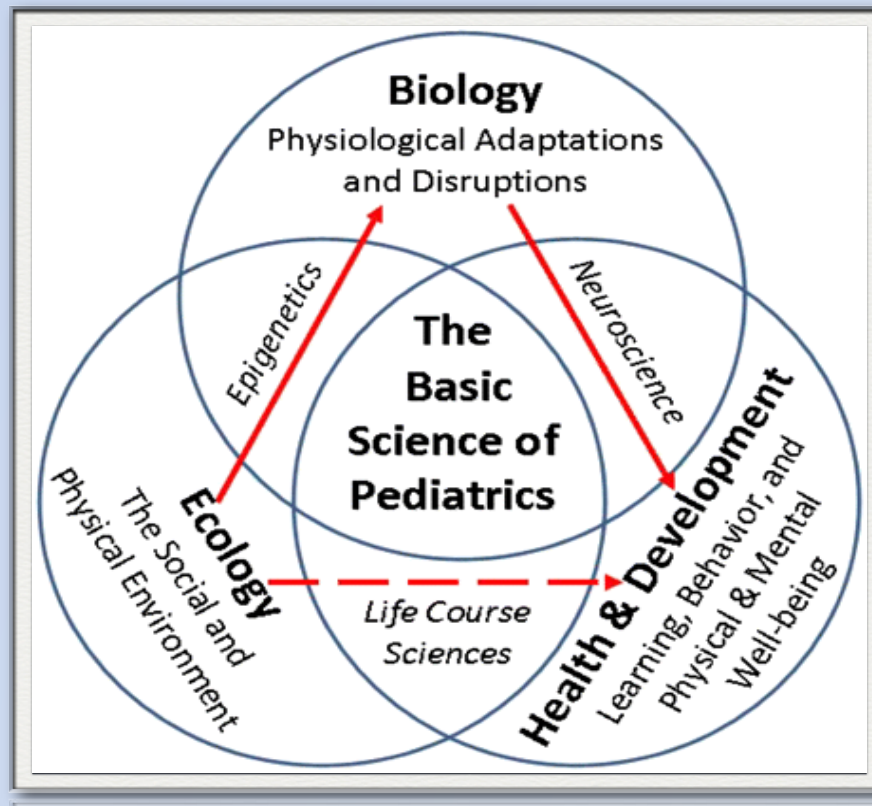
Source: "The Challenge: The Ability to Change Brains and Behavior Decreases Over Time." Conceptual graph created by Pat Levitt in collaboration with the Center on the Developing Child at Harvard University (2009) and published in *From Best Practices to Breakthrough Impacts: A Science-Based Approach to Building a More Promising Future for Young Children and Families* (2016). Accessed June 16, 2018.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



What shapes the developing brain?



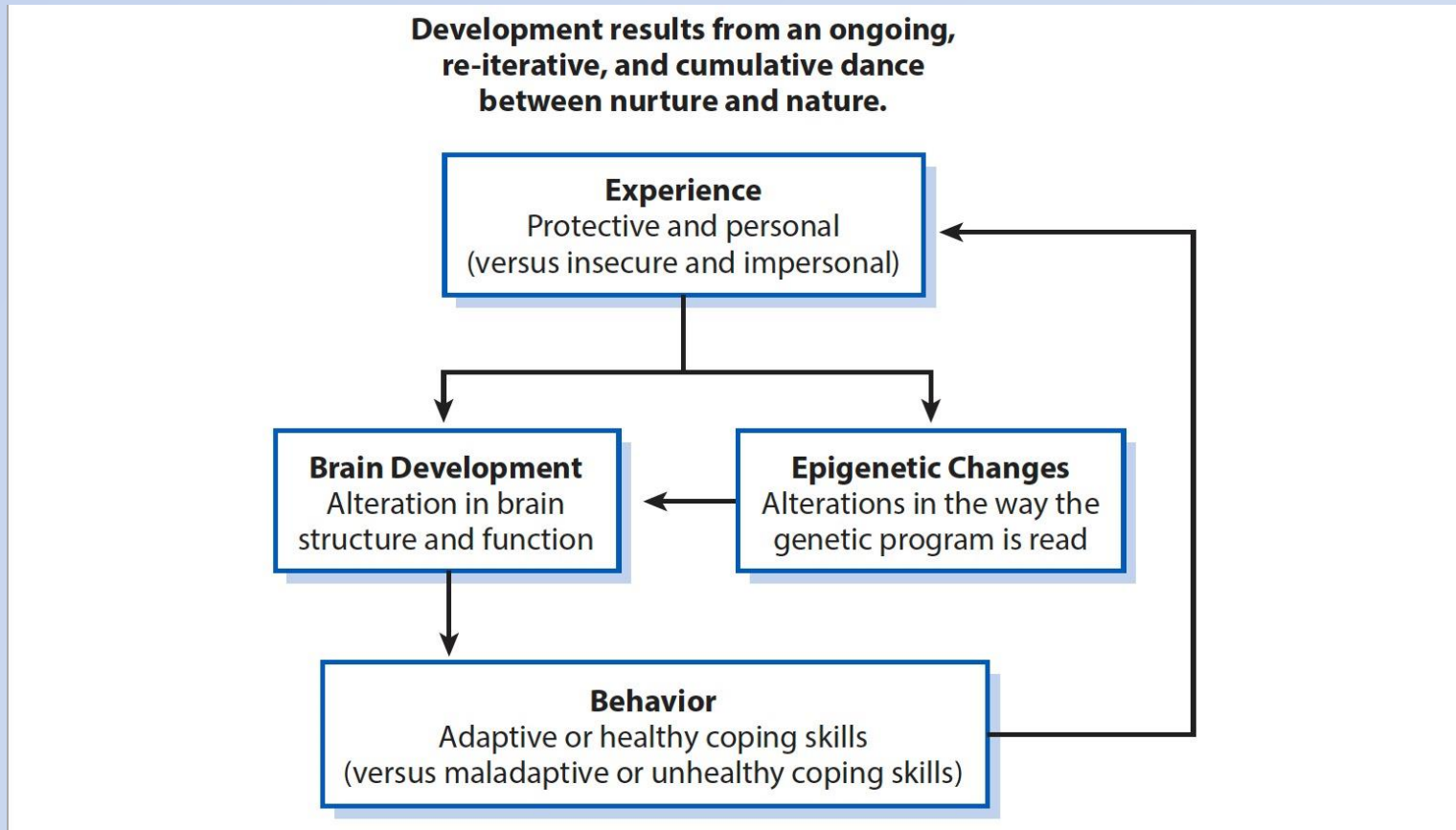
Shonkoff JP, Garner AS, American Academy of Pediatrics Committee on Psychosocial Aspects of Child and Family Health, Committee on Early Childhood, Adoption, and Dependent Care, Section on Developmental and Behavioral Pediatrics. The lifelong effects of early childhood adversity and toxic stress. *Pediatrics*. 2012;129(1):e232-e246. doi: 10.1542/peds.2011-2663.

Parental Stress and Children's Genes

- Parents' stress leaves lasting marks on children's genes
- Higher stress levels reported by mothers during their child's first year correlated with methylation levels on 139 DNA sites in adolescents

Parent' stress leaves lasting marks on children's genes: UBC-CFRI research. The University of British Columbia Website. <https://news.ubc.ca/2011/08/30/parents-stress-leaves-lasting-marks-on-childrens-genes-ubc-cfri-research/>. Published August 20, 2011. Accessed July 17, 2018.

Development: Dance Between Nature and Nurture



From Bright Futures Guidelines for Health Supervision of Infants, Children and Adolescents, 4th ed.: Modified with permission from Garner A, Forkey H, Stirling J, Nalven L, Schilling S; American Academy of Pediatrics, Dave Thomas Foundation for Adoption. Helping Foster and Adoptive Families Cope With Trauma. Elk Grove Village, IL: American Academy of Pediatrics; 2015.
<https://www.aap.org/traumaguide>. Accessed July 19, 2018.

The Foundations of Health

- Stable and responsive environment and relationships
- Safe & supportive physical environments
- Appropriate nutrition

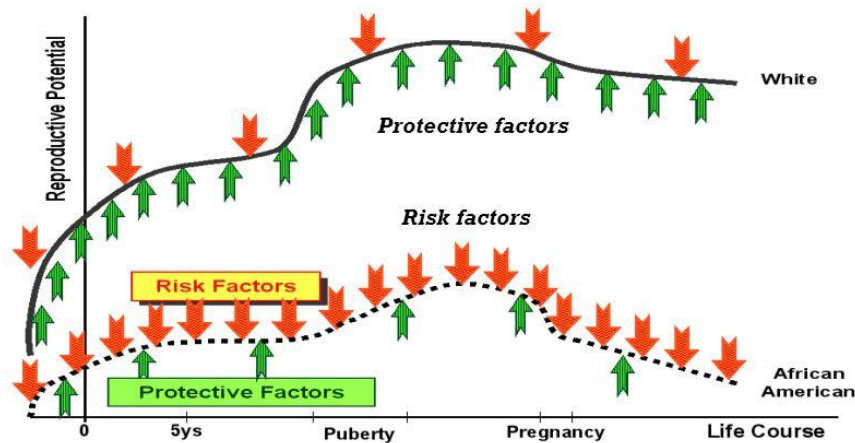


Source: Lifelong Health. Center on the Developing Child at Harvard University Website.

<https://developingchild.harvard.edu/science/deep-dives/lifelong-health/>. Accessed on July 19, 2018.

How Does Life Course Science Impact Children?

The Life Course Perspective (Lu, 2003)



Lu M, Halfon N. Racial and ethnic disparities in birth outcomes: a life course perspective. *Matern Child Health J* 2003; 7(1):13-30.



Early Brain Development: The Good, the Bad, and the Ugly

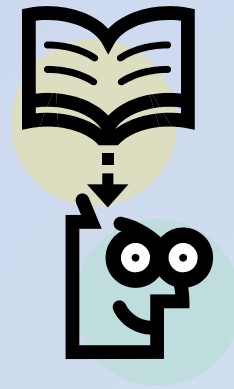


Nurturing caregiving
Responsive parenting
Discipline
Scaffolding play
Shared Reading



Toxic Stress

Key Concept 2



**Childhood adversity has lifelong
consequences**

How Do You Define Adversity or Stress?

- Stress is not necessarily a bad thing
- Based on the perception and reaction (objective physiologic responses):
 - Positive stress response
 - Tolerable stress response
 - Toxic stress response

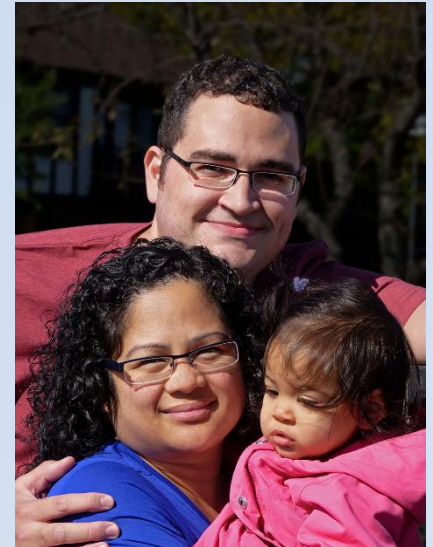
Source: Toxic Stress. Center on the Developing Child at Harvard University Website.
<https://developingchild.harvard.edu/science/key-concepts/toxic-stress/>. Accessed on July 16, 2018.

Positive Stress Response

- Brief, infrequent, mild to moderate intensity
- Most normative childhood stress
 - 2 year-old stumbles while running
 - Beginning school or child care
- Social emotional buffers allow a return to baseline
- Builds motivation and resiliency
- Positive Stress is **not** the absence of stress

Tolerable Stress Response

- Exposure to non-normative experiences
 - Death in family
 - Natural disaster
- Social emotional buffers can provide protection and promote a return to baseline
- A single major negative event does not necessarily mean long-lasting problems



SourceToxic Stress. Center on the Developing Child at Harvard University Website.
<https://developingchild.harvard.edu/science/key-concepts/toxic-stress/>. Accessed on
July 16, 2018.

Toxic Stress Response

- Long lasting, unremitting stress, not a “single bad stressor”
- Adverse child experiences
 - Abuse
 - Household dysfunction
- Insufficient social-emotional buffering
- Potentially permanent changes and long-term effects
- Epigenetics
- Brain architecture

Source Toxic Stress. Center on the Developing Child at Harvard University Website.
<https://developingchild.harvard.edu/science/key-concepts/toxic-stress/>. Accessed on
July 16, 2018.

Impact of Early Stress



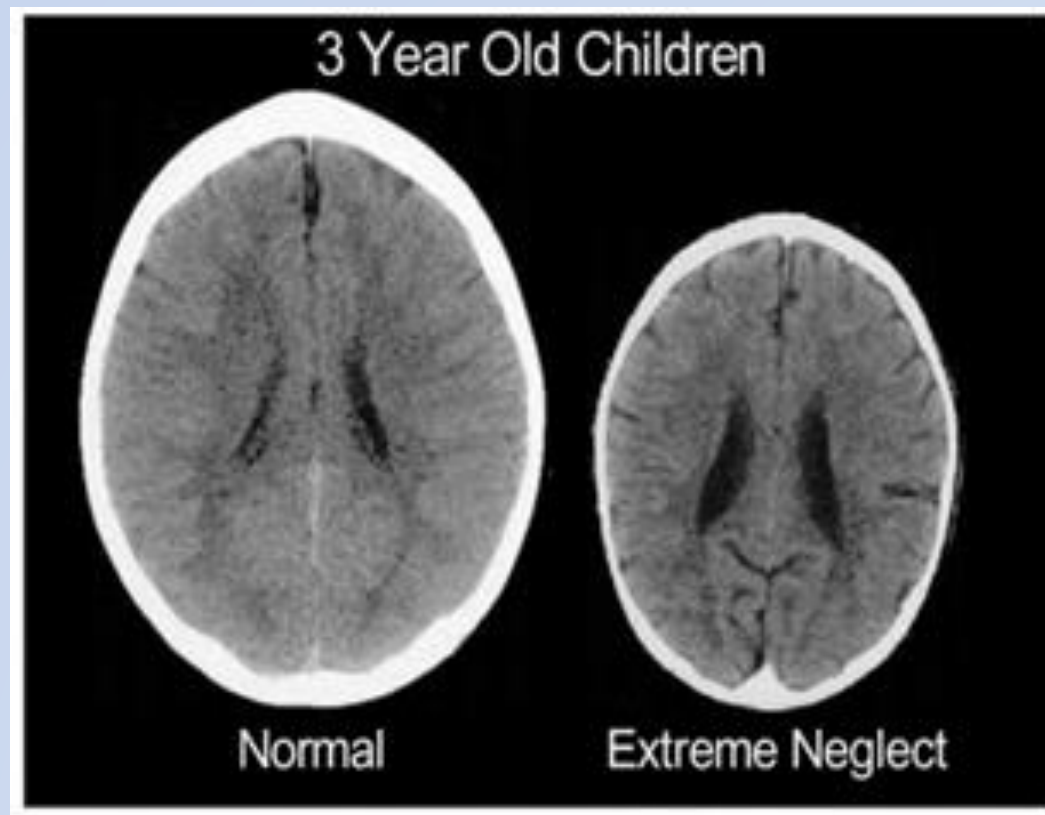
CHILDHOOD STRESS

**Hyper-responsive
stress response;
↓ calm/coping**

**Chronic “fight or
flight;” ↑ cortisol /
norepinephrine**

**Changes in Brain
Architecture**

Early Stress



Source: Perry BD. Childhood experience and the expression of genetic potential: What childhood neglect tells us about nature and nurture. *Brain and Mind* 2002; 3(1):79-100. doi: 10.1023/A:1016557824657.

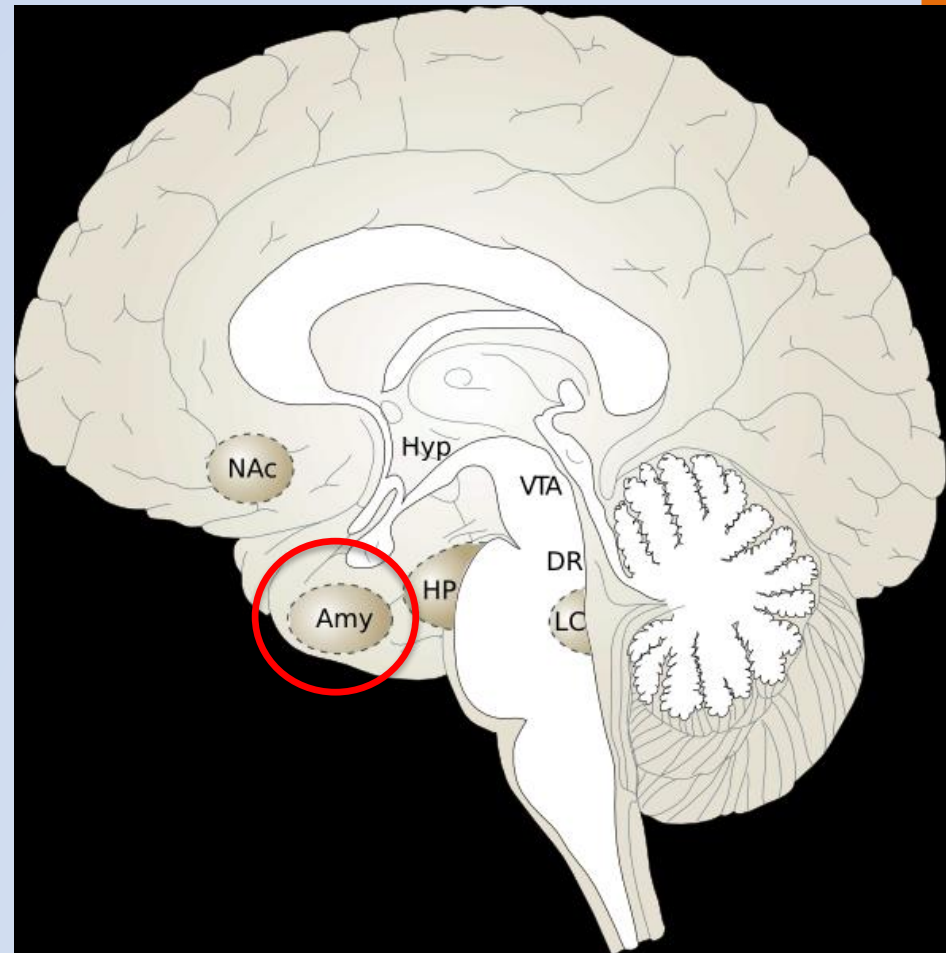
Adverse Childhood Experiences (ACE) Study

- One the largest studies to assess associations between childhood maltreatment and later health and well-being
- Findings suggest that certain experiences are major risk factors for illnesses and poor quality of life

Violence Prevention: Adverse Childhood Experiences (ACEs). Centers for Disease Control and Prevention Website. <https://www.cdc.gov/violenceprevention/acestudy/>. Updated April 1, 2016. Accessed July 16, 2018.

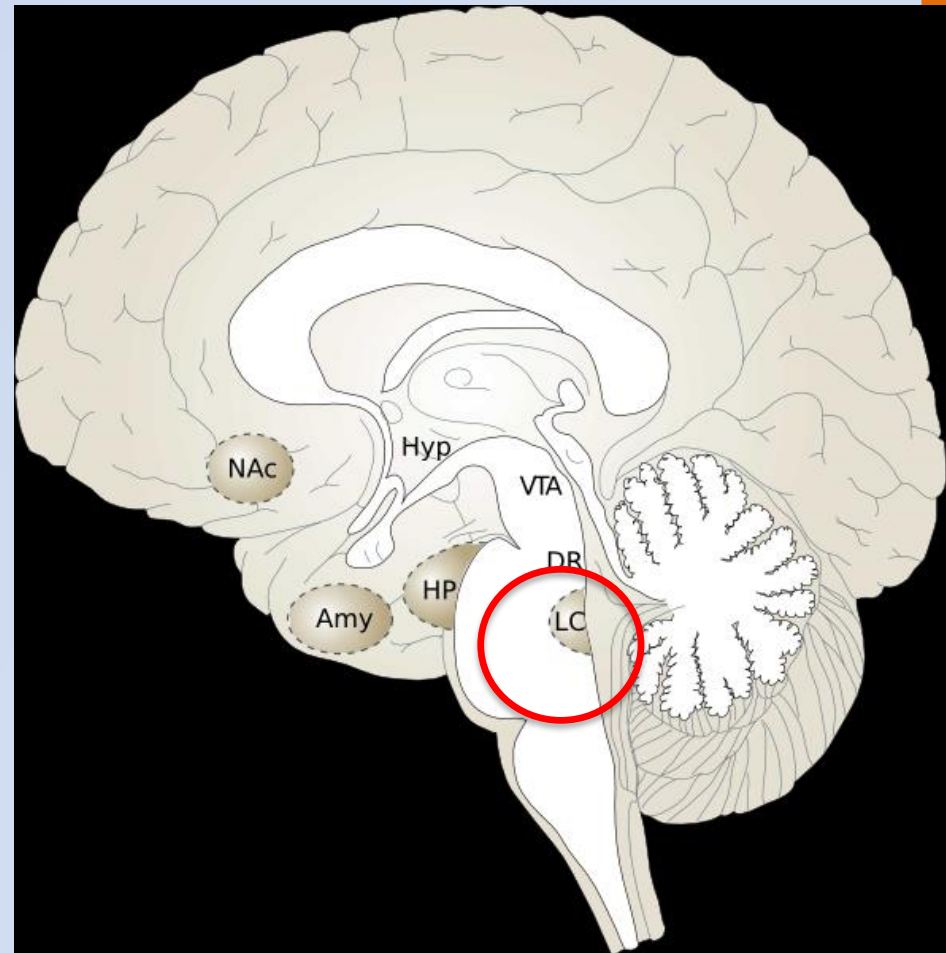
Brain Dysregulation

- **The Amygdala:** the brain's fear center.
- When the amygdala is exposed to toxic stress, it becomes overactive, and produces exaggerated fear responses to stimuli.
- In other words, it sounds an internal alarm even when one isn't needed.



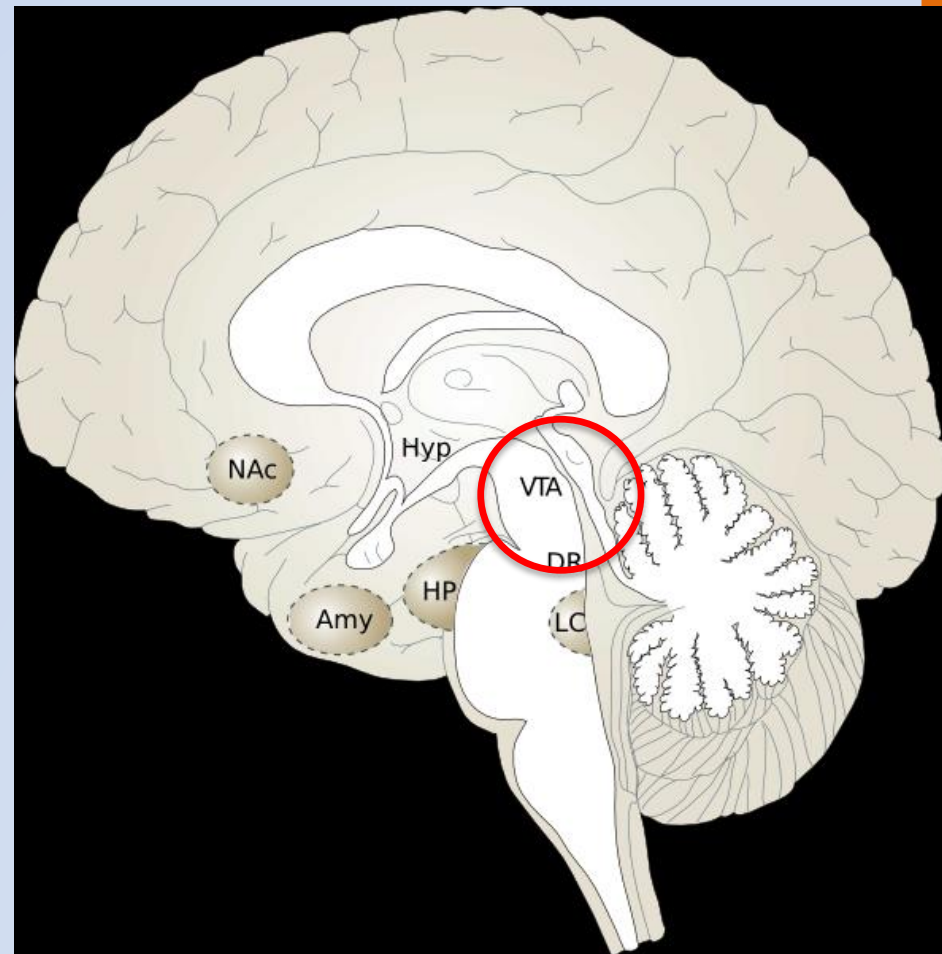
Brain Dysregulation

- The **locus coeruleus** is the brain's center for regulation of aggression and impulse control.
- Toxic stress can dysregulate this part of the brain and lead to release of noradrenaline, causing increased anxiety, arousal, vigilance, and aggression.



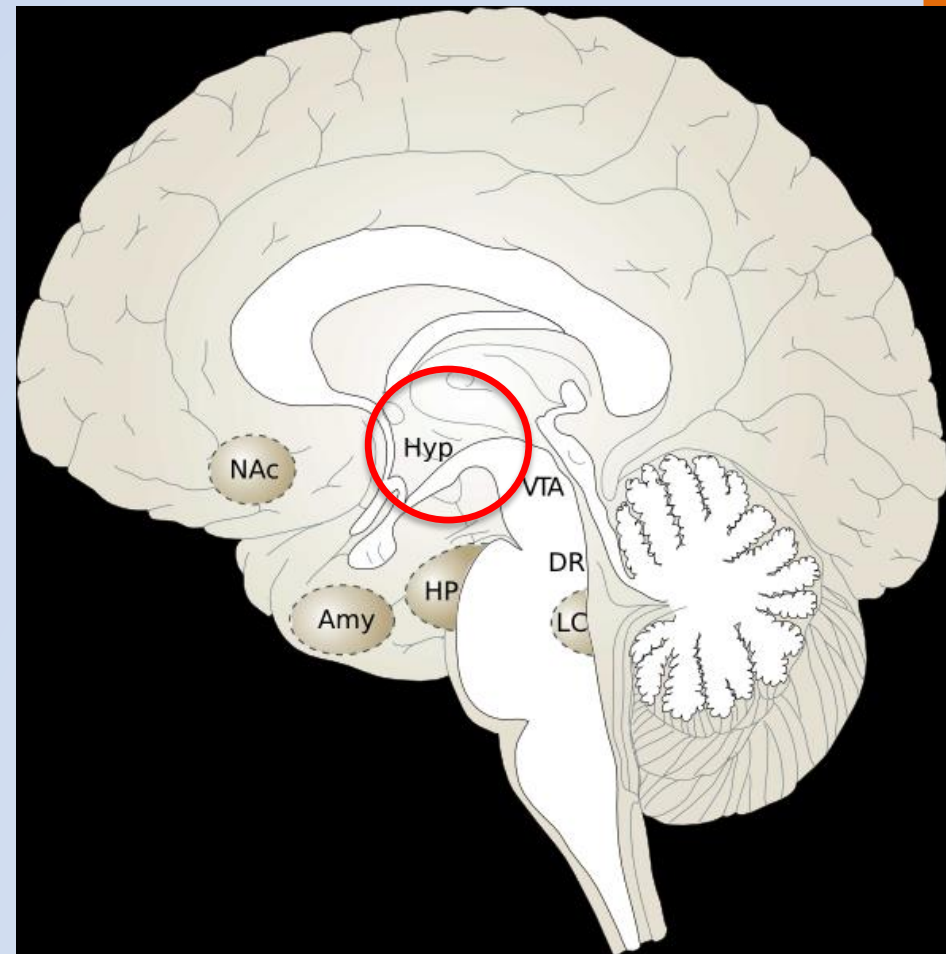
Brain Dysregulation

- **The Ventral Tegmental Area (VTA)** is a key to the reward circuitry of the brain.
- This part of your brain controls motivation, intense love, and addiction through dopamine receptors.
- Toxic stress dysregulates this area, potentially leading to increases in risky pleasure-seeking behaviors.



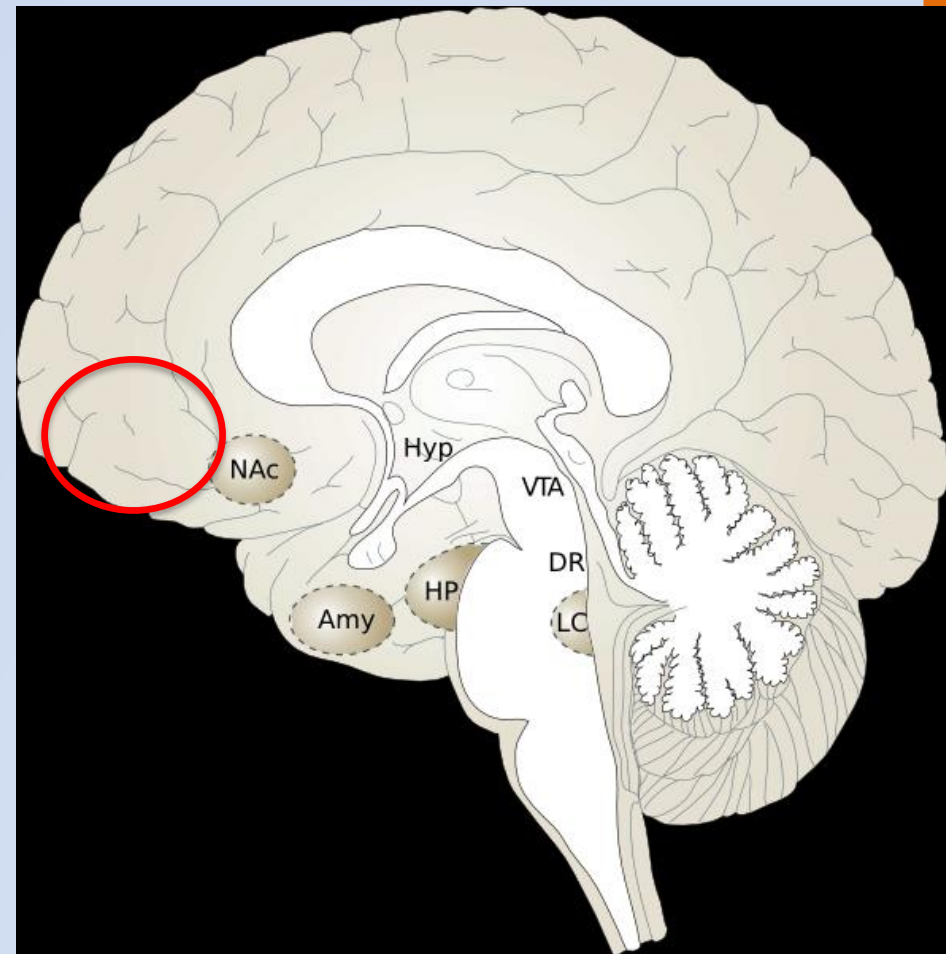
Brain Dysregulation

- The **hippocampus** helps the brain with short term and long term memory.
- When exposed to toxic stress, the hippocampus struggles to maintain memories and creates learning difficulties.



Brain Dysregulation

- The **prefrontal cortex** is the most evolved part of the brain, that acts as the director of operations.
- This area controls reason, judgment, planning, and decision-making.
- Dysregulation due to toxic stress exposure can lead to attention issues, concentration problems, impulsivity, and problem-solving difficulty.



Multi-Systemic Alterations



Neurologic

- Dysregulation of HPA and SAM Axes
- Activation of the amygdala
- Inhibition of the prefrontal cortex
- Hippocampal neurotoxicity
- VTA and reward center dysregulation



Immunologic

- Increased inflammatory mediators
- Inhibition of anti-inflammatory pathways
- Impaired cell-mediated acquired immunity



Endocrine

- Affects stress hormones
- May alter thyroid function
- May alter pubertal timing



Cardiovascular

- May cause blood pressure dysfunction

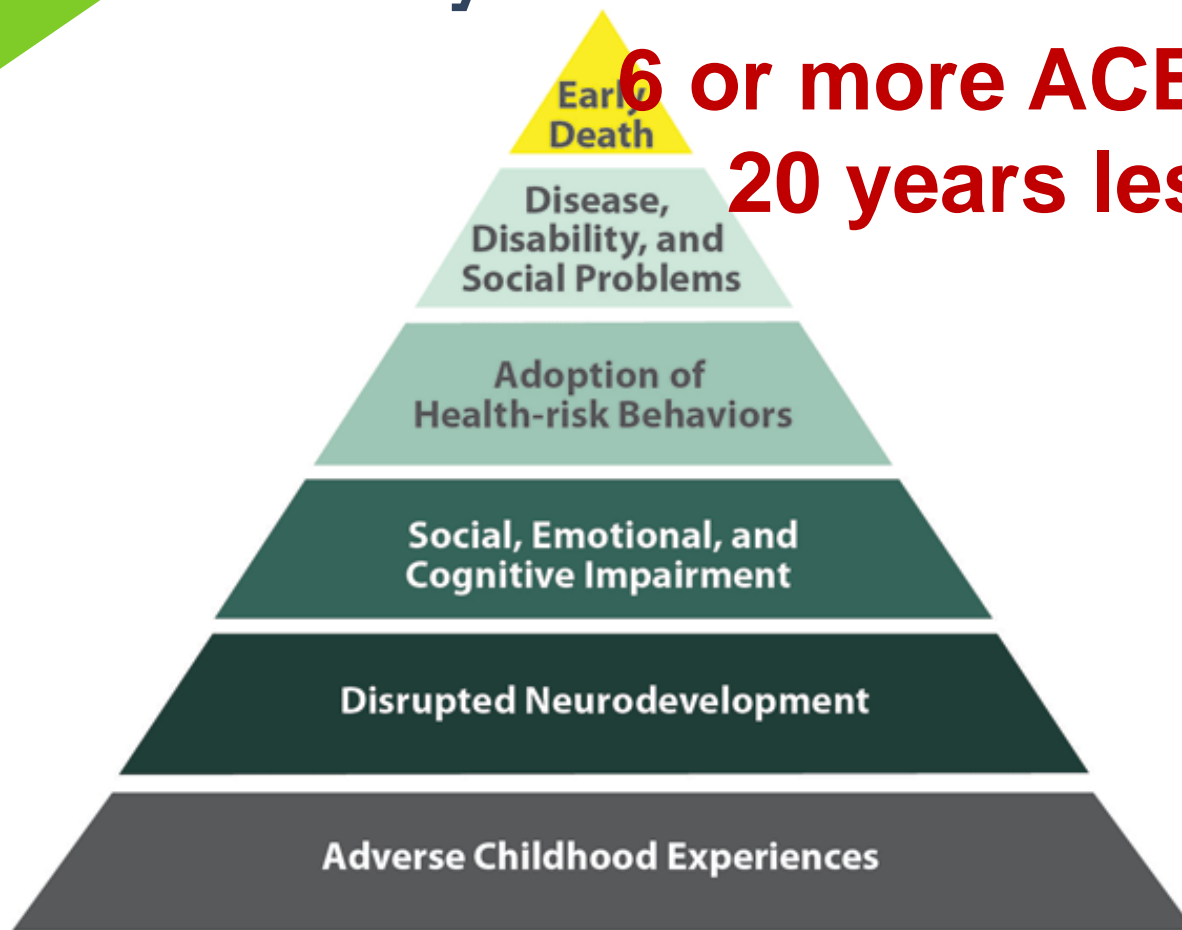


Epigenetic

- Changes in the way DNA is read and expressed leads to changes in the way the brain and organ systems respond to stress.
- Telomere erosion leads to premature cell death and altered cell replication



ACE Pyramid

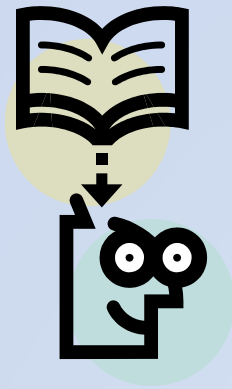


**6 or more ACES →
20 years less!**



Mechanism by Which Adverse Childhood Experiences
Influence Health and Well-being Throughout the Lifespan

Key Concept 3



Responsive caregiving is the most important buffer for toxic stress

“Social-emotional buffering is the primary factor distinguishing tolerable from toxic level of stress.”



Andrew Garner, MD, PhD, FAAP
Chair, AAP EBCD Leadership Work Group (2012-2014)

Desired Protective Factors

For Families

- Concrete support in times of need
- Social connections
- Knowledge of parenting and child development
- Personal resilience
- The ability to enhance social and emotional competence in children
- The ability to foster nurturing and attachment

Strengthening Families: A Protective Factors Framework. Center for the Study of Social Policy.

<https://www.cssp.org/young-children-their-families/strengtheningfamilies/about#protective-factors-framework>.

Accessed July 26, 2018.

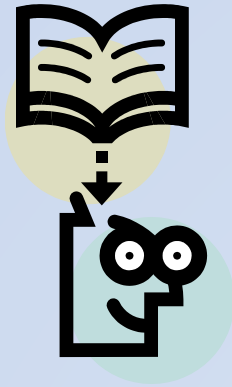
Desired Protective Factors

For Communities

- Safe neighborhoods
- Safe, high quality schools
- Stable and safe housing
- Access to nutritious food
- Access to job opportunities
- Access to medical care (including behavioral health and wellness care)
- Access to transportation
- Access to safe, high quality, affordable child care
- Inclusion and equity related to race, ethnicity, and disability

Strengthening Families: A Protective Factors Framework. Center for the Study of Social Policy. <https://www.cssp.org/young-children-their-families/strengtheningfamilies/about#protective-factors-framework>. Accessed July 26, 2018.

Critical Concept 4



**What can you do to
make it better?**

The Solution:

AAP 2012 Toxic Stress Policy Statement supporting
trauma-informed policies, programs, and practices

PROVIDERS SHOULD:

KNOW IT
TEACH IT
PRACTICE IT
ADVOCATE FOR IT

MEDICAL HOMES SHOULD:

Counsel on responsive
parenting and S/E skills
Screen for stress
Refer to community-based
programs
Innovate for kids and
families

Trauma-informed care (TIC)

is based in ***compassion and empathy***, and strives to empower families and help them feel ***safe, secure, and loved.***

It's not "What's wrong with you?"
But "What happened to you?" And "How can I help?"



Trauma-informed Care (TIC)

Realizing

the widespread impact of trauma and understanding potential paths for recovery

Recognizing

the signs and symptoms of trauma in clients, families, staff, and others involved with the system

Responding

by fully integrating knowledge about trauma into policies, procedures, and practices; and

Resisting

re-traumatization

<https://www.samhsa.gov/nctic/trauma-interventions>

Development is a Dance Between Nature and Nurture

- **What you can do:**
 - Apply an ecobiodevelopmental framework
 - Recognize adverse psychosocial factors
 - Collaborate with families and social service providers
 - Conduct developmental and behavioral monitoring and screening



Family-Centered Means:

Values

- Full family focus
- Family led
- Respect
- Strength-based
- Racial equity and inclusion

Operational Principles

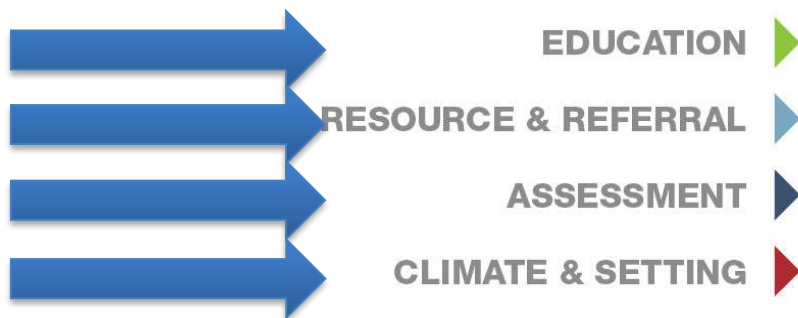
- Fluidity of approach
- Transparent
- Choice
- Responsiveness

Source: W. K. Kellogg Foundation. Family-Centered Coaching: A toolkit to transform practice and empower families. 2016. <http://www.buildingbetterprograms.org/wp-content/uploads/2016/12/Family-Centered-Coaching-Toolkit-Draft-Version.pdf>. Accessed July 13, 2018.

Breaking the cycle: pediatric and family care

<https://training-source.org/url/xh>

4 PILLARS Trauma-Informed Pediatric Care Guide



<https://www.iowaaces360.org/>

Promoting EBCD



The First 1,000 Days: Examples for Promoting EBCD consistent with Bright Futures Guidelines for Health Supervision of Infants, Children and Adolescents, 4th ed

PEDIATRICIANS are Encouraged to →	Explore the child's environment	Build relationships / reciprocity	Cultivate development	Develop parenting confidence
General Principles →	What pediatricians might briefly assess during well child care	How pediatricians might strengthen the parent-child bond or attachment	What pediatricians might teach parents about development	How pediatricians might support parents as they nurture their child's development
Brief Description Well Child Care Visit	Assess foundational needs: *Food and sleep *Safety *Social and emotional supports *Strengths and barriers to success	Describe (or notice) parent-child interactions, emphasize the importance of responsive caregiving, and support the parent-child relationship ("dyadic dance")	Explain current and emerging developmental skills	1) Praise and encourage age-appropriate but responsive caregiving. 2) Praise and encourage parental self-care and the nurturing of social supports
Prenatal/Newborn/Week 1	Assess for food (plans to breastfeed?), safety, and parental supports	Explain that relationships and everyday interactions build the baby's brain	Explain the importance of parent-baby interaction during the infant's "quiet-alert" state	Encourage parents to consider the way they were parented. Explore what they plan TO do and NOT to do as parents.
2-4 weeks	Assess overall parental well-being (maternal depression or substance use?)	Encourage responsive caregiving (responding promptly to cries of distress builds trust)	Prepare parent for the emerging social smile	Find opportunities to reassure and praise the parents, and encourage them to support each other
2 months	Assess for family adjustment – parent self-care, return to work/childcare, time with partner, impact of new infant on siblings	Encourage smiling back at the baby's social smile (the beginning of the parent-child interaction, or "dyadic dance," that leads to cooing, feeding and speaking)	Anticipate cooing conversations	Enjoy interactions with an increasingly social baby

*This grid is not intended to be a comprehensive resource, but rather provides examples of some evidence-informed actions consistent with the Bright Futures Guidelines for Health Supervision of Infants, Children and Adolescents, 4th ed that proactively address the child-parent/caregiver relationship and the child's development. For more early brain and child development information and resources, visit the EBCD Web site at www.aap.org/ebcd and the Bright Futures Web site at www.brightfutures.aap.org

The First 1000 Days: Examples for Promoting EBCD Consistent with Bright Futures Guidelines for Health Supervision of Infants, Children and Adolescents, 4th ed. https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/EBCD/Documents/EBCD_Well_Child_Grid.pdf, Accessed August 28, 2018



The First 1,000 Days: Examples for Promoting EBCD

Consistent with
Bright Futures Guidelines for Health Supervision
of Infants, Children and Adolescents, 4th ed.

- Explore the Child's environment
- Build relationships/reciprocity
- Cultivate development
- Develop parenting confidence

Source: https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/EBCD/Documents/EBCD_Well_Child_Grid.pdf. Accessed July 2018

Building Capacities: Executive Functioning

Includes:

- Working Memory
- Mental Flexibility
- Self-control

Executive Function & Self-Regulation. Center on the Developing Child at Harvard University Website. <https://developingchild.harvard.edu/science/key-concepts/executive-function/>. Accessed on July 16, 2018.

Impacts:

- School readiness
- Math and reading competence
- Job productivity
- Positive relationships
- Overall quality of life

Diamond A. Executive functions. Annu Rev of Psychol. 2013; 64: 135-168. doi: 10.1146/annurev-psych-113011-143750.

Building capacities: Self-regulation

Children who cannot effectively regulate anxiety or discouragement tend to move away from, rather than engage in, challenging learning activities.

Sleep

Exercise

Nutrition

Relaxation

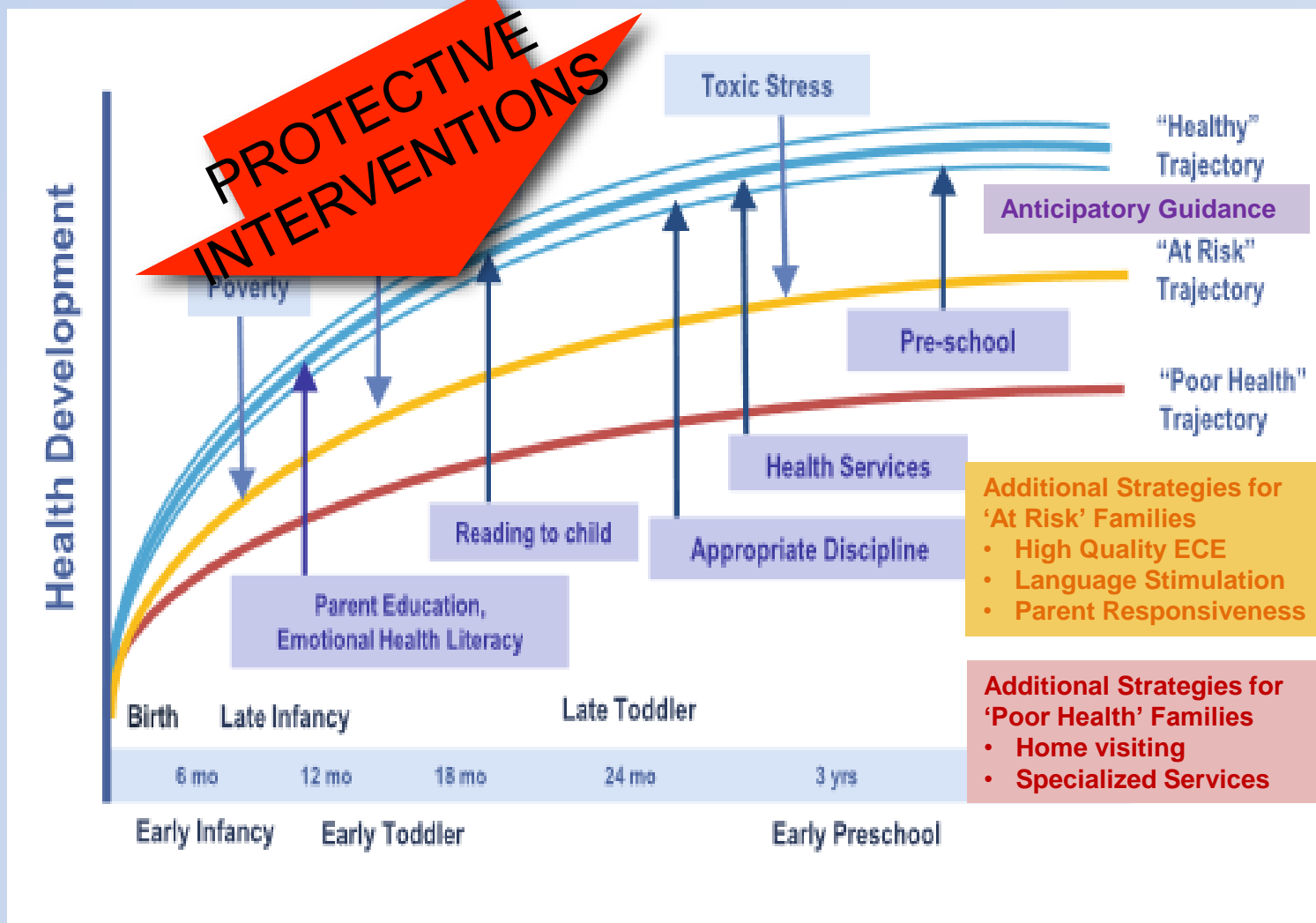
Mental Health

Relationships

Promote the Five R's of Early Childhood Education

- **Reading** together as a daily family activity
- **Rhyming**, playing, talking, singing, & cuddling together often
- **Routines** & regular times for meals, play, & sleep, which help child know what they can expect and what is expected of them
- **Rewards** for everyday successes, realizing that praise from those closest to a child is a very potent reward
- **Relationships** that are reciprocal, nurturing & enduring are the foundation of healthy child development

Strategies to Improve Developmental Trajectories



Source: Halfon N, Larson K, Lu M, Tullis E, Russ S. Lifecourse Health Development: Past, Present and Future. *Matern Child Health J.* 2014; 18(2): 344-365. doi: 10.1007/s10995-013-1346-2.

Take Home Messages

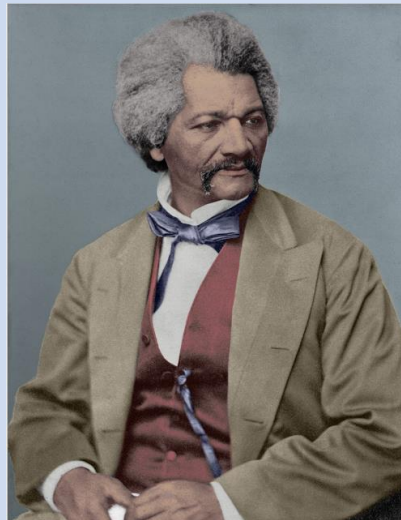
Change the **LENS** we use to **PRIORITIZE** how we use our limited time w/ families:

- Use an **ecobiodevelopmental** framework
- Understand **life-course** theory and **developmental trajectories**
- Know the **biological** threats to healthy life courses
- Identify/address **environmental risks** early
- Whenever possible, **proactively build wellness**

Take Home Messages

It is easier to build strong children than
to repair broken men.

Frederick Douglass



Questions?

